[12604/13]

HOUSING AND FIELD DEVICE

Background of the Invention

The present invention relates to a housing and a field device.

Electrical devices that are used in industrial facilities in the field are also exposed to dirt, dust, water and other substances. This frequently results in failures.

The present invention thus begins with the objective of refining a housing and a field device that are usable in a high protection class and can nevertheless be produced in a cost-effective manner. In particular, electronics should also be protectable and connectable in the field, that is, in the case of spray water for example.

According to the present invention, the objective is achieved with respect to the housing by the features specified in Claim 1 and with respect to the field device by the features specified in Claim 16.

Essential features of the present invention with respect to the housing are the fact that the housing includes a housing part designed as a hood and that the hood has at least one opening in one direction, particularly in the direction of gravity, that is, at the bottom.

In this regard, it is advantageous that a quick and simple assembly is made possible, that imperviousness is provided and that the housing as well as the three-part field device can be produced in a cost-effective manner. In addition, assembly and maintenance may be performed in a particularly simple and cost-effective manner. It is also essential that in the case of a possible replacement of defective components such replacement can be performed in a particularly simple and

rapid manner. Here it must be noted that such a replacement is to be performed not only mechanically but also in terms of information technology. Due to the at least three-part construction, the parameterizing effort required following a replacement of electronic components may be significantly reduced in the present invention. This is because of, in particular, the at least three-part construction of the housing, which, in case of a defect, allows for a quick mechanical replacement of the hood together with the electronics insert, while in the stationary lower part, which essentially includes the connection terminals for electrically connectable devices, a data storage unit may be provided, which holds the characteristic data, parameters or merely a characteristic address on hand and ready for retrieval. Already from the address information alone, the electronics insert is able to retrieve via a data bus the parameters and additional parameterizing data stored in a central computer and thus able to perform its own parameterization automatically. Substantial time savings can be achieved in this manner, particularly compared to the related art, in which field devices must have a specially provided interface via which the data are to be imported during parameterization.

In additional specific embodiments of the present invention, the housing is constructed as one piece. A high protection class and a particularly high degree of imperviousness can thus be achieved.

In additional specific embodiments of the present invention, the hood only has one or more openings downward, that is, in the direction of gravity. Thus, no water can reach the electronics insert, even if the entire facility is exposed to flooding.

In additional specific embodiments of the present invention, the hood is shaped such that water drains away, particularly under the influence of gravitation, without water being able

to collect in one place at the hood. This advantageously reduces the danger of corrosion.

In additional specific embodiments of the present invention, the hood is produced by deep drawing, particularly from sheet metal, or by pressure diecasting or by injection molding. The hood can thus be produced in a cost-effective manner.

In additional specific embodiments of the present invention, the hood includes a lower and an upper hood part, the upper hood part being designed with a vaned profile, particularly for forming a heat sink and/or for improved dissipation of heat to the environment. Thus, even one or more electronic circuits, which as converters power a motor, can be integrated in the electronics insert.

In additional specific embodiments of the present invention, the lower and the upper hood parts are designed as one piece. It is thus advantageous that a high degree of imperviousness and a high protection class can be achieved.

In additional specific embodiments of the present invention, the electronics insert is imperviously joined to the inner side of the hood. In this regard, it is of advantage that the hood together with the electronics insert can be quickly replaced in maintenance or repair cases. The purely mechanical connection terminals, by contrast, are located in the connection box and thus do not have to be replaced in the case of a defective electronics insert. This makes it possible to reduce costs.

In additional specific embodiments of the present invention, the electronics insert has a plug-in connector unit in the direction of the connection box. This advantageously allows for a quick and simple connection.

In additional specific embodiments of the present invention, the plug-in connector unit has a sealed design. In particular, the plug-in connector unit has molded-in contact pins for the function of sealing, the plug-in connector unit being connected to the electronics insert by a seal. Thus the electronics insert may be provided with the sealing of a high protection class.

In additional specific embodiments of the present invention, the housing includes at least one electronics insert and at least one connection box. In particular, the electronics insert may be joined by friction-locking to the hood, particularly to its upper part. Thus, the electronics insert and the hood may even be joined so as to form a seal in a particularly simple and cost-effective manner. In particular, an additional seal can also be provided between the hood and the electronics insert.

In additional specific embodiments of the present invention, the electronics insert is joined by form-locking and friction-locking to a mounting support, which is clasped by the upper part of the hood. In this way, it is possible to provide not only floor mounting, but wall mounting as well.

In additional specific embodiments of the present invention, the electronics insert has first plug-in connectors, that is, plug-in connector units, in the direction of gravity. In particular, the connection box has second plug-in connectors, that is, corresponding plug-in connector units for connecting to the first plug-in connectors.

In additional specific embodiments of the present invention, the connection box has openings for feeding in cables on the lower side, that is, in the direction of gravity. Advantageously, the hood can also protect these cable feeds against at least vertically falling rain. For this purpose, the hood can be designed so that its lower edge is extended

out over the connection box, thus improving protection against rain.

In additional specific embodiments of the present invention, the connection box is joined to the hood in a form-locking and impervious manner, in particular with the aid of an interposed seal. In particular, the electronics insert has at least two seals for an impervious connection to the hood, that is, at its circumference and on the plug-in connector.

In additional specific embodiments of the present invention, the field device is designed for decentralized use in an industrial facility. Thus the field device can be designed to have an electronics insert that includes PC functionality and can be installed and operated in the field, that is, also in a wet zone for example. In place of PC functionality, converter functionality for powering electric motors can also be integrated into the electronics insert. The heat of the power output stage of the converter can then be dissipated to the environment via the hood specially fitted with cooling vanes.

Further advantages result from the dependent claims.

List of Reference Numerals

11 Hood
12 Mounting support
13 Mounting plate
14 Wall
20 Electronics insert
21 First plug-in connectors
22 Seal
29 Threaded rods
30 Connection box
31 Second plug-in connectors
32 Form-locking region
33 Seals
34 Quick-change fastener

35 Lower side of housing
36 Cable feed
37 Cooling vanes
38 Side plate
41 Hood
42 Cooling vanes
43 Mounting plate
44 Fastening bolt
45 Hinged housing part of the connection box
46 Guide rail
47 Plug-in connector unit
48 PG cable glands for low voltage
49 PG cable glands for power supply
50 Lower housing part of the connection box
51 Additional housing part of the connection box
52 Connection terminals
61 Hood
62 Device switch
63 Additional housing part of the connection box
64 Housing part

The present invention will now be explained in more detail with reference to illustrations:

Fig. 1 shows the field device mounted to a wall.

Fig. 2 shows the field device in an exploded view, where the connection box, the electronics insert and the housing part in the form of a hood can be seen.

Fig. 3 shows the hood.

Fig. 4 shows the connection box with the side plate lifted off laterally.

Fig. 5 shows the field device from a different angle.

Fig. 6 shows the electronics insert.

Fig. 20-22 schematically show a further exemplary embodiment according to the present invention. In this context, Figure 20 shows the field device. Figure 21 shows hood 41 lifted off. Figure 22 shows one housing part opened.

Fig. 23,24 show a further, similar exemplary embodiment of the present invention, in which a device switch is provided.

The field device has a housing construction of a high protection class and is thus especially suited for the installation of decentralized control technology in the field of an industrial facility.

In its overall construction, the field device has a structure made up of at least three parts, including a housing part designed as hood 11, an electronics insert 20 and a connection box 30. Downwards, that is, in the direction of gravity, connection box 30 additionally has the function of forming the housing.

The electronic circuit is designed as a converter electronics circuit. In additional specific embodiments of the present invention, other electronic circuits can be provided as well, for example control electronics, switching-function electronics for a motor or smooth-start device electronics.

In this context, hood 11 has a one-part design and has no opening in the upward or in the lateral direction. Only a downward opening, that is, in the direction of gravity, is provided. Thus in flood conditions for example, only a certain portion of the interior volume in the lower region of

the lower part of the hood can be flooded, if seals and other provided measures should fail.

Hood 11 is deep-drawn from sheet metal or produced by pressure diecasting or injection molding. At least in its upper part, hood 11 is provided with a vaned profile for cooling the electronics. In the exemplary embodiment of the present invention according to Figures 1, 2, 3, 6, the vaned profile is designed to extend across the entire length of the hood.

In further improved exemplary embodiments of the present invention, the hood is always formed, the cooling vanes are designed, and the mounting direction is selected in such a way that water or other liquids can run off unimpeded on the outside of the hood. Thus, there are no depressions or the like where water could collect. This increases corrosion protection.

Electronics insert 20 includes an electronic circuit and is fastened to connection box 30 by threaded rods 29 and nuts 34. In additional specific embodiments of the present invention, fastening may also be provided by friction-locking, especially also in the upper half of the hood. In particular, a bayonet lock may also be used advantageously.

Heat transfer to hood 11 is ensured at least via form locking and/or friction locking. An additional screw joint is optionally possible. Contacting occurs via plug-in connection 21.

Connection box 30 is connected to electronics insert 20 via a plug-in connection, which is made up of first plug-in connector 21 and second plug-in connector 31.

The electronics insert may also have seals 22 for producing an impervious connection with the hood.

Cable feed 36 leading to electronics insert 20 is provided on the underside of connection box 30. Depending on protection class and requirement, further exemplary embodiments of the present invention provide for cable feed 36 to be implemented from below via plug-in connectors or PG cable glands. The figures show PG cable glands 36 in bottom side of housing 35 of the connection box.

The side walls of the connection box are joined to the interior walls of hood 11 in a form-locked manner, that is, with a precise fit. This joining produces a certain imperviousness, for example, to dust and the like. The imperviousness for attaining a high protection class is achieved with the aid of seals 33.

In additional exemplary embodiments of the present invention, a maintenance switch is optionally integrated into connection box 30 from below.

Fastening for connection box 30 is provided via an integrated mounting support. The cable routing for the electrical connections is fed through mounting support 13 from below. In additional exemplary embodiments of the present invention, it can also be led through laterally. Mounting support 13 also has an elongated hole for a futher optional cable lead-through.

Assembly occurs following the manufacture of electronics insert 20 in that the latter is preassembled in the hood, which can then be slipped onto the connection box.

Contacting occurs via first and second plug-in connectors (21, 31). Connection box 30 is bolted to the hood from below by a quick-change fastener 34. Especially a bayonet lock can be used advantageously for this purpose.

To provide sealing, the mounting position of the hood is such that the hood is mounted downward, that is, in the direction of gravity. This ensures that any liquid from above and from all four sides will drip off via the hood. Connection box 30 is protected by this principle as well. Only the bottom side for the cable feed can come into contact with liquid, for example in the case of flooding.

With the aid of connection box 30, bottom side of housing 35 is protected by sealing, form-locked connection 32 to the hood and two additional seals 33.

The hood having mounted electronics 20 is made impervious to dust by virtue of the form-locked connection of the electronics insert with the hood and sealing surface 22. Thus, the electronics are even protected in the unmounted state.

Connection box 30 is itself designed to be impervious to dust.

The heat of the electronic circuit of the electronics insert is dissipated via upper hood part 11 and the cooling vanes embossed therein. Lower hood part 10 stays cooler.

The drainage of condensed water in the connection box can be ensured by the structural design. Connecting terminals 37 are attached so as to be spatially separated from the condensed water collection area.

Figures 20 through 22 schematically show a further exemplary embodiment of the present invention.

In this context, Figure 20 shows the field device. Figure 21 shows hood 41 lifted off, an electronics insert in the hood being joined to it. Figure 22 shows one housing part opened.

Hood 41 is provided with cooling vanes 42, which are merely hinted at in the figures. These are shaped in such a way that water can always run off and does not remain anywhere.

In additional exemplary embodiments of the present invention, cooling vanes 42 run all the way through from top to bottom.

In Figures 20 through 22, the field device can be mounted to a wall by its mounting plate 43 joined to the connection box, and by fastening bolt 44 inserted through the recesses of the mounting plate. Mounting plate 43 also has a guide rail 46, which simplifies and facilitates the mounting of hood 41 of the field device.

The connection box is made up of a lower housing part 50, a further housing part 51 mounted on top of it and another housing part 45 attached to the latter in a pivoted manner such that it can be opened.

The connection box has plug-in connector units 47 and 47a, by which connection terminals 52 located in the connection box can be electrically connected to the electronics insert, which in Figures 20 through 22 is already located inside hood 41. The electronics insert has corresponding plug-in connector units that have a sealed design. In particular, the plug-in connector unit has molded-in contact pins, the plug-in connector unit being connected by a seal to the electronics insert.

Mounted to its lower housing part 50, the connection box has PG cable glands 48 for low voltage and PG cable glands 49 for power supply. Thus cables coming from other devices may be connected to connection terminals 52 in an impervious manner.

Figures 23 and 24 show a further, similar exemplary embodiment of the present invention. Here, a device switch 62 having a housing part 64 that is joined to the other housing part 63 of

the connection box of the field device is attached to the connection box. The switch is designed to be impervious, that is, to be in a high protection class and watertight. The protection class may also be IP64 or higher. This remaining components and are similar to the components of the exemplary embodiment according to Figure 20 through 22. The device switch is also especially suited for maintenance.

The electronics insert can also be designed to have converter functionality. In this instance, the power electronics are connected in a heat-conducting manner to the hood, the heat being able to dissipate via the cooling vanes. The electric motor, electrically connected to the electronics insert via the connection terminals of the connection box, is powered by the converter circuit of the electronics insert. Furthermore, the electronics insert has connections for inputs and outputs for connecting sensors and/or actuators via the connection terminals of the connection box. In addition, supply lines such as 24 V and field bus lines can be connected as well. Field bus lines, power supply lines, that is, high-voltage lines, and supply lines, particularly 24 V lines, are wired in a T-shaped manner in the connection box. Thus additional field devices can be electrically connected in a serial manner.

An electronic data storage unit having long-term stability, for example an EEPROM, is also provided in the connection box. Thus, an address can be stored, and during initial operation and parameterization the electronics insert is able to obtain the data intended for this address from a central control system via the field bus, and may therefore be parameterized in a rapid and simple manner. Presetting information can also be stored in the data storage unit.

The connection box can always be joined to the facility in a fixed and/or detachable manner. Thus, in case of faults in

the electronics, only the hood together with the electronics insert needs to be exchanged.

Another advantage of the connection box is that, depending on the customer and the facility, it is possible definitively to stipulate a wiring that is specific to this facility. Thus it is possible to supply always the same field device for different facilities with the appropriate wiring. For this purpose, the connection box can also be configured to have a patch board between the terminal strip for the connection terminals and the PG cable glands.